SOFTWARE DOCUMENTATION (14 June 2001)

for

DERIVATIVE OUTLOOK WEIGHTS

(a *Windows* application for using meteorology probability forecasts)

PURPOSE

The software provides the means to do three main tasks, essential in the construction of derivative outlooks from meteorology probability forecasts. The first task is to enter all of the meteorology forecast information available to the decision maker, including all agency forecasts of meteorology probabilities and most-probable events, as well as probability forecasts that otherwise may be available. Part of this first task is also to sort through all of the entered information and arrange the forecast equations in a meaningful order of priority, enabling later computations to omit the lower-priority equations when necessary to effect a solution to the set of remaining equations. The second task is to define the parameters of the simulations used in the operational hydrology methodology to make a derivative forecast. These include the period of the forecast and the identification of the pieces of the historical meteorology record (up to 150 pieces allowed), which are to be used as possible scenarios in the model simulations. These two tasks can proceed independently, although it is relevant to use meteorology forecasts that are timely to the derivative forecast being made, and hence to the simulation parameters involved in the methodology. The third task is to construct the weight equations, representing the probabilistic meteorology outlooks, and to solve them for the weights to apply to the simulated outputs of the operational hydrology approach. The third task is dependent on the first two tasks. These three tasks have been separated into three software applications, respectively, available as modules in the program documented herein.

These computations can be conveniently performed through an interactive graphical user interface, entitled *Derivative Outlook Weights*. This is a 32-bit *Windows*™ application designed for *Windows95*™, *Windows98*™, *WindowsNT*™ (version 4.0) and *Windows2000*™. It is freely available over the World Wide Web from the Great Lakes Environmental Research Laboratory. This interface enables people to intuitively use the multitude of confusing probabilistic meteorology outlooks available in making their own derivative probabilistic outlooks. This documentation describes the software, its installation, and usage, provides helpful notes on making outlooks with the software, and summarizes the application and files provided in the interface package.

ACQUISITION

The software may be acquired in a self-installing file (NOAAWGHT.EXE) by downloading from the following web site:

http://www.glerl.noaa.gov/wr/OutlookWeights.html

Inquiries may be made to:

Thomas E. Croley II
Great Lakes Environmental Research Laboratory — 734 741-2238
2205 Commonwealth Blvd. — FAX: 734-741-2055
Ann Arbor, Michigan 48105-2594 — email: Croley@glerl.noaa.gov

CONVENTIONS

Specific type styles are used herein to indicate the following items in this documentation, as illustrated by these examples:

Directories and filenames	(SUPERIOR, CLIMATE.SUP)
Program, module, and dialogue box titles	(**Directory Selection**)
Menus and menu selections	(*Change Directory*)
Text in the program and modules main windows	("Current Directory")
Button commands and hints	("Simulations")

In this documentation, sidebars (boxed material) such as this denote special user instructions in a series of continuing exercises. They are designed to quickly familiarize the user with the software interface. They are labeled for cross-reference to reference four as exercises 1-4.

INSTALLATION

The installation software installs *Derivative Outlook Weights* for *Windows95*, *Windows98*, *WindowsNT* (version 4.0) or *Windows2000*. It also installs example data (in subdirectory EXAMPLES DATA). If the exercises are run according to the instructions in the sidebars following, the results should agree with those sidebars. The following steps should ensure trouble-free installation:

1. After downloading or copying the file NOAAWGHT.EXE into a working directory, run NOAAWGHT.EXE to automatically install this product via an installation wizard. Answer the questions during the installation process to choose the installation directory. (The examples here presume that E:\OUTLOOKS is the installation directory. Substitute your installation directory in the examples that follow.) NOTE: this product can be installed over an earlier version and will use any configuration or data files built by the earlier version.

2. *Optionally*, create another application area directory, if desired, to keep groups of user applications separate. The user will then be able to maintain different configurations of *Derivative Outlook Weights* for each separate group. This can be done at any later time or the default (EXAMPLE) can be used. (The program creates subdirectory EXAMPLE the first time that the user extracts data from an archive in subdirectory EXAMPLES DATA.) It may be convenient to create them as subdirectories in the installation directory but it is not necessary. In any new application directory, create historical meteorology files, CLIMATE.???, for each application area desired in the group to be placed in the application directory. This may be accomplished with the aid of appropriate commands within *Derivative Outlook Weights* (see **USAGE** following.) The 3-character extension (???) refers uniquely to an application area (e.g., in the examples archived in ZIP files contained in subdirectory EXAMPLES DATA, CLIMATE.SUP refers to the Lake Superior basin application area and CLIMATE.MIC refers to the Lake Michigan basin application area). See **FILES** for more information on the CLIMATE.??? file.

3. *Optionally*, after successful completion of the installation, delete, if desired, all files in the working directory except DERIVATIVE OUTLOOK WEIGHTS.EXE and UNZDLL.DLL.

4. *Optionally*, to use old OTLKSETS.??? or OTLKEC3.??? files, created by earlier versions of this software, convert to the new formats by using appropriate commands from within *Derivative Outlook Weights* (see **USAGE** following). Note, ??? again refers to a 3-character extension

referring uniquely to an application area. See **FILES** for more information on the OTLKSETS.??? or OTLKEC3.??? files.

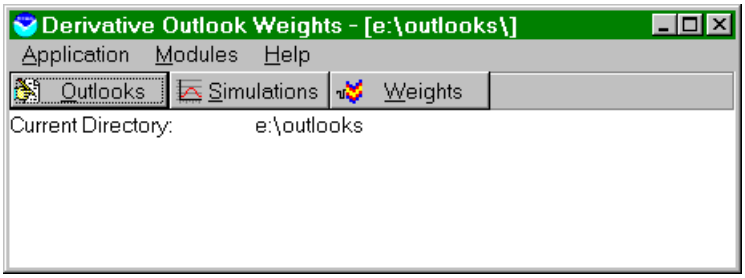

Fig. 1. "**Derivative Outlook Weights**" Initial Window.

USAGE

The program *Derivative Outlook Weights* may be run by invoking it from the *Windows* "Start" menu, by double-clicking with the mouse on a desk top link icon, by double-clicking on the file name in *Windows Explorer* or *Windows NT Explorer*, by typing its name into the **Run** dialog box (accessible from the "Start" menu), or by typing its name at the command prompt in an MSDOS console window. After invoking *Derivative Outlook Weights* the very first time, the user should be presented with a display similar to Figure 1. Figure 1 shows the default home directory as if the software was installed into directory OUTLOOKS on the "E:" drive. This appears in the title of the window (as **Derivative Outlook Weights – [e:\outlooks\]**) and in the field marked "Current Directory" (as "e:\outlooks"). Figure 2 shows a typical view after the software has been used for a while. By selecting the *Application* drop-down menu on the main menu bar, as in Figure 3, and then selecting *Set Directory…* (denoted herein as *Application / Set Directory…*) the user invokes the **Directory Selection** dialog box (not shown). From there the user can select application directories in the standard *Windows* fashion. Simply double-clicking with the mouse anywhere in the main window of **Derivative Outlook Weights** also accesses this dialog box. Note, new directories or subdirectories can be created from within the *Derivative Outlooks Weights* program; they also can be deleted from within the program, but only if they are empty and not in use by other programs at the time.

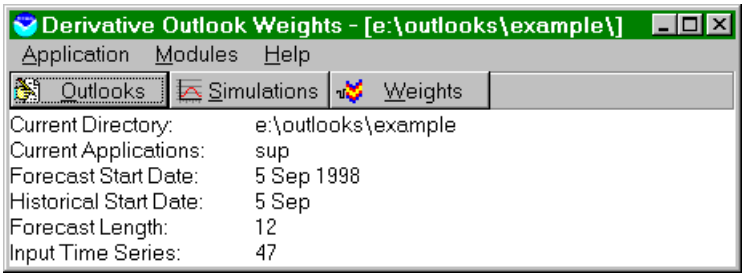

Fig. 2. "**Derivative Outlook Weights**" Example Settings.

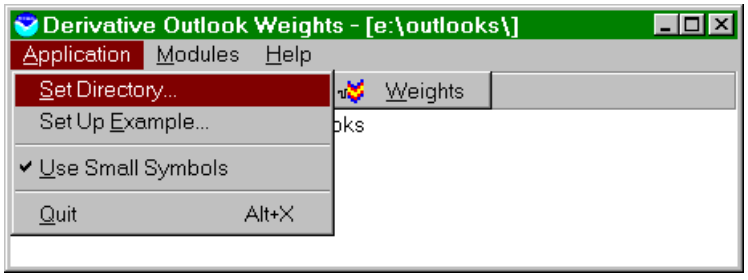

Fig. 3. "**Derivative Outlook Weights**" Application Menu.

Exercise 1

As an exercise, with the *Derivative Outlook Weights* program running, select *Application / Set Up Example…* to invoke the **Pick An Example** dialog box. Select "Example01", and click on the "accept selection" button on the left (let the cursor rest on any of the buttons for a hint to appear as to its function). This action should provide the **Successful Example Set Up** dialog box with a message indicating successful extraction of files. Click on the "OK"

button. [Selecting "Example01" clears the EXAMPLE subdirectory and extracts AGNCSTRC, CLIMATE.SUP, and SIMULATE.$$$ into it from the EXAMPLE01.ZIP archive (located in the EXAMPLES DATA subdirectory). It also switches to the EXAMPLE subdirectory]. The main window of **Derivative Outlook Weights** should be similar to Figure 2.

Climate Outlooks Settings Module

There are three modules that can now be invoked from the main window of **Derivative Outlook Weights**. They may be invoked from their respective buttons underneath the main menu bar, "Outlooks," "Simulations," and "Weights," or as sub-menu items under the *Modules* menu item on the main menu bar, *Outlooks*, *Simulations*, and *Weights*. Selecting these items invokes, respectively, the **Climate Outlooks Settings Module**, the **Simulation Settings Module**, and the **Mix Outlooks & Compute Weights Module**.

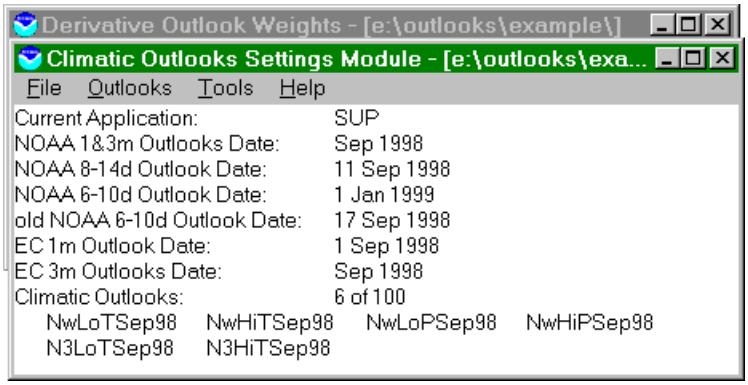

Fig. 4. "**Climatic Outlooks Settings Module**" Window.

The first, the **Climate Outlooks Settings Module**, is invoked through the "Outlooks" button or by selecting *Modules / Outlooks*. An example display is given in Figure 4. The **Climate Outlooks Settings Module** also displays the application directory in its title. This module allows the user to set each application area for subsequently entering available meteorological forecast information. It also allows outlook meteorology probabilities and agency outlook dates to be input, or previous inputs to be recalled, for six different agency forecasts as well as general probability statements (from additional agencies or user defined). Finally, this module allows the user to arrange all of the outlook probability statements, for a selected application area, in a priority ordering for subsequent computations. Current values (if any) for the application area, agency forecast dates, the number of outlooks used, and their priority order are displayed in the **Climate Outlooks Settings Module** window (see Figure 4). They appear in fields as follows. "Current Application" displays the application area. "NOAA 1&3m Outlooks Date" displays the effective month and year of the National Oceanic and Atmospheric Administration (NOAA) Climate Prediction Center's (CPC's) *Climate Outlook*, a one-month and 13 three-month forecasts of air temperature and precipitation probabilities. "NOAA 8-14d Outlook Date" displays the effective day, month, and year of the NOAA CPC's second-week, or eight-to-fourteen-day, forecasts of air temperature and precipitation probabilities. "NOAA 6-10d Outlook Date" displays the effective day, month, and year of the NOAA CPC's day-six-to-day-ten (five-day) forecasts of air temperature and precipitation probabilities. "old NOAA 6-10d Outlook Date" displays the effective day, month, and year of the old NOAA CPC's day-six-to-day-ten (five-day) forecasts of the most-probable air temperature and precipitation events. "EC 1m Outlook Date" displays the effective day, month, and year of the Environment Canada (EC) Canadian Meteorological Centre's (CMC's) one-month forecasts of the most-probable air temperature event. "EC 3m Outlook Date" displays the effective month and year of the first of EC CMC's 4 three-month forecasts of the most-probable air temperature and precipitation events. And "Climatic Outlooks" displays the

number of outlook probability statements to be used in making a derivative outlook and a listing of their priority order in an abbreviated format. These values may only be set or reset in the **Climate Outlooks Settings Module**.

Selecting An Application Area

By selecting *Outlooks / Select Area…*, shown in Figure 5, the user invokes the **Pick An Application** dialog box (not shown). From there the user can select, by check marking, one application area in the standard *Windows* fashion. Also possible there, the user can alternatively define a new application area, for which to enter forecast meteorology probabilities, by typing in a three-character mnemonic that refers uniquely to an application area. Simply double-clicking with the mouse in the "Current Application" field in the **Climate Outlooks Settings Module** window also accesses this dialog box.

Setting Effective Date of Agency Outlooks

This action is similar for each agency outlook, although the dates may be day, month, and year, or simply month and year, depending on the agency outlook being considered. By selecting *Outlooks / NOAA 8-14d Outlook*, *Outlooks / NOAA 6-10d Outlook*, *Outlooks / Environment Canada 1m Outlook*, or *Outlooks / Environment Canada 3m Outlooks*, a pop-up menu appears that is similar in function to that shown in Figure 5 for *Outlooks / NOAA 1m & 3m Outlooks*. Actions for all are similar to those described here for the latter.

By selecting either *Outlooks / NOAA 1m & 3m Outlooks / Date NOAA 1m & 3m Outlooks Today* or *Outlooks / NOAA 1m & 3m Outlooks / Enter NOAA 1m & 3m Outlooks Date…*, both of which are also shown in Figure 5, the user can set the effective date of the NOAA CMC *Climate Outlook* of one-month and 13 three-month forecasts of air temperature and precipitation probabilities to be used. Note that "effective date" is defined as the start date of the agency outlook (first) period, not to be confused with the issue date. The former selection sets the effective date to the month and year of the currently available *Climatic Outlook* (depicted in Figure 5 as June 2001). The latter selection invokes the **Enter Month & Year** dialog box (not shown). This allows the user to set the effective date between January 1995 (when the first *Climate Outlook* was issued) and the forecast date possible on the current date (e.g., if the current date is 21 May 2001, then the June 2001 outlook is available). Simply double-clicking with the

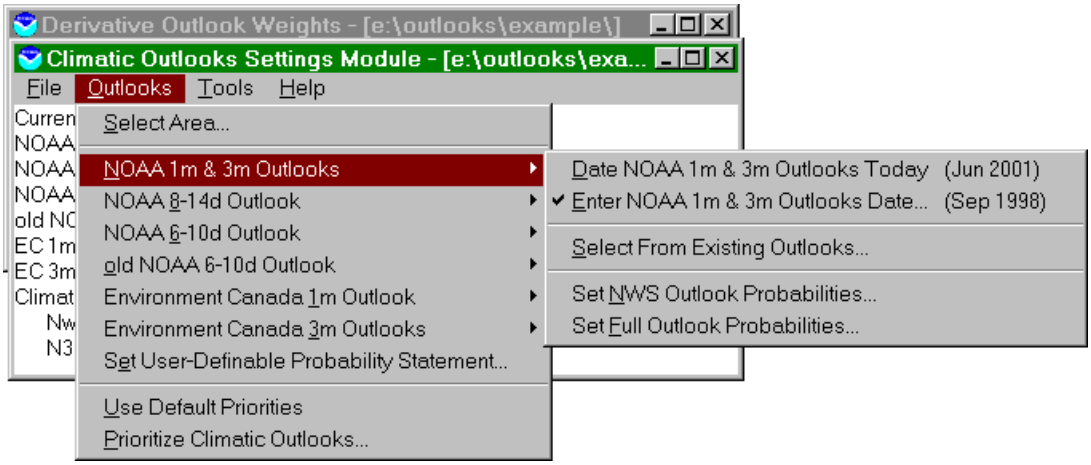

Fig. 5. "**Climatic Outlooks Settings Module**" Outlooks Menu.

mouse in the "NOAA 1&3m Outlooks Date" field in the **Climate Outlooks Settings Module** window also accesses this dialog box. Likewise, double clicking in any appropriate agency outlook date field in the main window accesses the date definition dialog boxes for that agency's outlook.

Selecting Existing Agency Outlooks

By selecting *Outlooks / NOAA 8-14d Outlook*, *Outlooks / NOAA 6-10d Outlook*, *Outlooks / old NOAA 6-10d Outlook*, *Outlooks / Environment Canada 1m Outlook*, or *Outlooks / Environment Canada 3m Outlooks*, a pop-up menu appears that is similar in function to that shown in Figure 5 for *Outlooks / NOAA 1m & 3m Outlooks*. Actions for all are identical to that described here for the latter. By selecting *Select From Existing Outlooks…* from this pop-up menu, the user invokes the **Pick An Outlook** dialog box (not shown). Then the user can select from previously entered outlooks, if any exist.

Defining Agency Outlook Probabilities

This action is similar for NOAA's one and three-month climate forecasts, NOAA's eight-to-fourteen-day forecasts, and NOAA's six-to-ten-day forecasts of event probabilities. By selecting either *Outlooks / NOAA 8-14d Outlook* or *Outlooks / NOAA 6-10d Outlook*, a pop-up menu appears that is similar in function to that shown in Figure 5 for *Outlooks / NOAA 1m & 3m Outlooks*. For the NOAA 6-10d Outlook, only one menu item is present, *Outlooks / NOAA 6-10d Outlook / Set Outlook Probabilities…*, instead of the two shown in Figure 5. It corresponds to the "Set Full Outlook Probabilities…" option for the other two agency outlooks. Actions for all are similar to those described here for the latter. By selecting either *Outlooks / NOAA 1m & 3m Outlooks / Set NWS Outlook Probabilities…* or *Outlooks / NOAA 1m & 3m Outlooks / Set Full Outlook Probabilities…*, both of which are shown in Figure 5, the user invokes the **Select NOAA 1- & 3-Mo. Periods & Define Probabilities** dialog box (not shown). The former selection invokes it with all probabilities defined as incremental changes or "NWS probabilities," especially useful since the outlook maps are defined in terms of these probabilities; see Figures 4-1 through 4-4 or 4-6 in Croley (2000a). (Simply double-clicking with the mouse in the "Climatic Outlooks" field in the **Climate Outlooks Settings Module** window brings up a pop-up menu, from which there is an entry that also accesses this dialog box.) The latter selection invokes the dialog box with all probabilities defined as absolute or "full probabilities;" see (4-4) or Figure 4-5 in Croley (2000a). This dialog box displays the 1 one-month forecast and the 13 three-month forecasts, any of which can be defined by check-marking them. In both cases, when first check-marked, or when an existing check mark is first cleared and then re-check-marked, a dialog box is invoked to actually set the probabilities. In the first case (NWS probabilities), the dialog box is **Enter NWS Excess Likelihoods** (not shown); in the second case (full probabilities), the dialog box is **Enter 4 Probabilities** (not shown). In either case, the user can then enter relevant air temperature and precipitation probabilities from the NOAA *Climate Outlook* of a one-month and 13 three-month forecasts or from the NOAA eight-to-fourteen-day forecasts, or from the NOAA six-to-ten-day forecasts. Please note that as defined by NOAA, there are only four basic types of distributions allowed: 1) "above normal" (probability of high exceeds one third with probability of low reduced accordingly), 2) "normal" (probability of middle range exceeds one third with probabilities of being low and high reduced accordingly and equally), 3) "below normal" (probability of low exceeds one third with probability of high range reduced accordingly), and 4) "climatological" (probabilities of one

third in each range are used). When entering probability incremental changes ("NWS" probabilities), the dialog box automatically converts them correctly to one of these four distributions. When entering "full" probabilities, the dialog box uses them exactly as entered and it is the users' responsibility to restrict themselves to these four distributions.

Defining Agency Outlook Most-Probable Events

This action is similar for the old NOAA six-to-ten-day outlook, EC's one-month outlook, and EC's extended three-month outlooks of most-probable events. By selecting *Outlooks / old NOAA 6-10d Outlook*, *Outlooks / Environment Canada 1m Outlook*, or *Outlooks / Environment Canada 3m Outlooks*, a pop-up menu appears that is similar in function to that shown in Figure 5 for *Outlooks / NOAA 1m & 3m Outlooks*, except that the last two items in the pop-up menu are replaced with a single item referring to the setting of the most-probable event. Actions for all are similar and are described here for the old NOAA six-to-ten-day outlook. By selecting *Outlooks / old NOAA 6-10d Outlook / Set NOAA 6-10d Most-Probable Event …* (not shown), the user invokes the **Set NOAA 6-10d Most-Probable Event** dialog box (not shown). (Simply double-clicking with the mouse in the "Climatic Outlooks" field in the **Climate Outlooks Settings Module** window brings up a pop-up menu, from which there is an entry that also accesses this dialog box.) This dialog box allows the user to pick the temperature and precipitation intervals that are forecast as most probable.

User-Defined Outlook Probabilities

By selecting *Outlooks / Set User-Definable Probability Statement…*, which is also shown in Figure 5, the user invokes the **Define User Probability Statements** dialog box (not shown). This dialog box displays user-defined probability statements (initially the default is five), any of which can be defined by check-marking them. When first check-marked, or when an existing check mark is first cleared and then re-check-marked, the **Define User Probability Statement** dialog box (not shown) is invoked to actually set the probabilities. [Note that the former is plural and the latter is singular.] The user can then enter relevant variable type (temperature or precipitation), statement type (less than, less than or equal to, equal to, greater than or equal to, or greater than), reference quantile definitions, forecast dates, and probabilities. The beginning and ending dates may be any day from 1 January 1995 through 31 December of the year two years after the current year. [The two-year period is changeable by selecting *File / Reference Settings / User Event Minimum Period…*, shown in Figure 6, which invokes the **Enter A Number** dialog box (not shown).] The user-defined probability outlooks may correspond to other-agency outlooks, not directly supported in the software, or to probability statements of the user's choosing. Simply double-clicking with the mouse in the "Climatic Outlooks" field in the **Climate Outlooks Settings Module** window brings up a pop-up menu, from which there is an entry that also accesses the **Define User Probability Statements** dialog box.

Defining Outlook Priorities

By checking *Outlooks / Use Default Priorities* (shown in Figure 5) or *File / Reference Settings / Use Default Priorities* (shown in Figure 6), the previously set default ordering of probability statements are used to establish their priority order. These default priorities may be defined (set) or reset (to values original to the software) by selecting *File / Reference Settings / Set Default Priorities…* or *File / Reference Settings / Reset Default Priorities…*, respectively (both shown in Figure 6). Both invoke the **Order by Priority (by dragging)** dialog

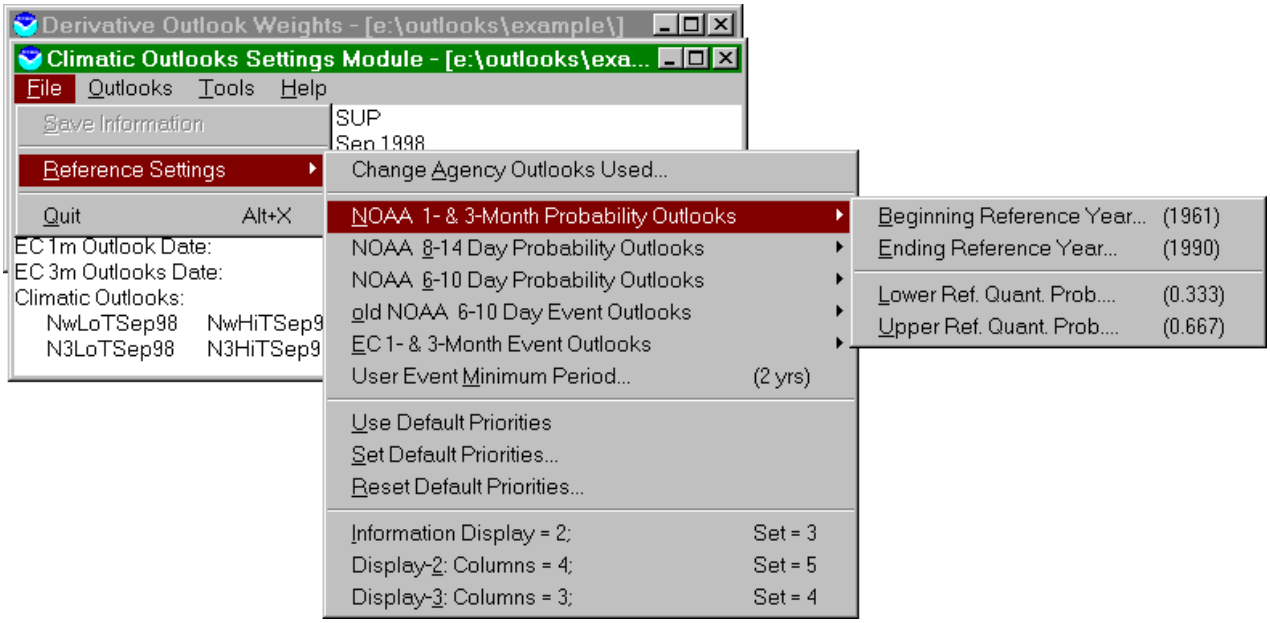

Fig. 6. "**Climatic Outlooks Settings Module**" File Menu.

box (not shown) for use in defining the default priorities. By selecting *Outlooks / Prioritize Climatic Outlooks…*, shown in Figure 5, the user invokes the **Order by Priority (by dragging)** dialog box (not shown) for use in arbitrarily ordering the probability statements instead of using default priorities. Then the user may simply drag the probability statements, displayed there, in standard *Windows* fashion to reorder them and to define which are actually included in the ordering. Simply double-clicking with the mouse below the "Climatic Outlooks" field in the **Climate Outlooks Settings Module** window also accesses the **Order by Priority (by dragging)** dialog box. Note, that if the user uses default priorities by selecting *File / Reference Settings / Use Default Priorities*, a check mark will appear next to that menu selection and the user will be unable to arbitrarily order probability statements in the **Order by Priority (by dragging)** dialog box. If the user wishes to arbitrarily order probability statements, then he or she must first reselect *File / Reference Settings / Use Default Priorities* to clear the check mark there.

Saving Climatic Outlook Settings

Anytime an entry to one of the agency outlook definitions is made and accepted, it is stored on disk. The user may switch between application areas and enter forecast information for each without losing earlier entries. The "current" settings shown in the main window when exiting the module will be the settings recalled to the main window the next time that the **Climatic Outlooks Settings Module** is invoked on the same application area. If any changes were made to the current settings shown in the main window since selection of the application area and not yet saved, the module will prompt the user to also save them separately for use by the third module (**Mix Outlooks & Compute Weights Module**), at exit time or when the user attempts to switch application areas. By selecting *File / Save Information*, when enabled, the user can save all current selections separately for use by the third module. If no selections were set or reset since the last time the **Climatic Outlooks Settings Module** was used on the present application area, then the *File / Save Information* menu item is disabled (grayed out) as

shown in Figure 6. Whenever any of the fields are set or reset, the *File / Save Information* menu item is enabled.

Exercise 2

As a continuing exercise, run the *Derivative Outlook Weights* program or, if already running, exit from any module currently running, if necessary, to return to the **Derivative Outlook Weights** main window. Select *Application / Set Up Example…* to invoke the **Pick An Example** dialog box. Select "Example02", and click on the "accept selection" button on the left (let the cursor rest on any of the buttons for a hint to appear as to its function). [This action clears the EXAMPLE subdirectory, extracts files into it from the EXAMPLE02.ZIP archive (located in the EXAMPLES DATA subdirectory), and informs the user as to its successful completion.] The main window should appear similar to that shown in Figure 2. Then open the **Climate Outlooks Settings Module** by selecting either the "Outlooks" button or *Modules / Outlooks*. The window display should be blank. Select *Outlooks / Select Area…*, to invoke the **Pick An Application** dialog box, and select the "SUP" application, which is the only one shown. Click the "accept selection" button (left-most button). The window should no longer be blank but appear similar to Figure 4.

Exercise 2a

Select *Outlooks / NOAA 1m & 3m Outlooks / Date NOAA 1m & 3m Outlooks Today* to set the effective date to the latest available outlook. [The **Order by Priority (by dragging)** dialog box will appear. Simply click the "accept priority order" button (left-most button).] Select *Outlooks / NOAA 1m & 3m Outlooks / Enter NOAA 1m & 3m Outlooks Date…* to invoke the **Enter Month & Year** dialog box and enter September 1998. (Again, accept the priority order in the dialog box that appears.) Alternatively, select *Outlooks / NOAA 1m & 3m Outlooks / Select From Existing Outlooks…* to invoke the **Pick An Outlook** dialog box and select the September 1998 outlook already defined. (Again accept the priority order in the dialog box that appears. Ordinarily, one would use only one of these three methods.) These actions are similar for other agency outlook definitions and will not be repeated in the following exercises (2b through 2f). Note again that "effective date" is defined as the start date of the agency outlook (first) period, not to be confused with the issue date. Thus, the September 1998 outlook begins in September even though it was issued in mid-August.

Select *Outlooks / NOAA 1m & 3m Outlooks / Set NWS Outlook Probabilities…*, to invoke the **Select NOAA 1- & 3-Mo. Periods & Define Probabilities** dialog box, and compare the settings there with Table 4-1 in Croley (2000a). Clear and then re-check-mark the September setting to invoke the **Enter NWS Excess Likelihoods** dialog box and experiment with the settings there. When finished, exit by selecting the "cancel settings" button and then exit from the **Select NOAA 1- & 3-Mo. Periods & Define Probabilities** dialog box by selecting its "cancel" button. Next, select *Outlooks / NOAA 1m & 3m Outlooks / Set Full Outlook Probabilities…* to invoke the **Select NOAA 1- & 3-Mo. Periods & Define Probabilities** dialog box (this time with "full" probabilities displayed) and compare the settings there with Table 4-1 and Figure 4-5 in Croley (2000a). Clear and then re-check-mark the September setting to invoke the **Enter 4 Probabilities** dialog box and experiment with the settings there. When finished, exit by selecting the "cancel" button and then exit from the **Select NOAA 1- & 3-Mo. Periods & Define Probabilities** dialog box by selecting its "cancel" button. (Ordinarily, one would only use either *Set NWS Outlook Probabilities…*

or *Set Full Outlook Probabilities…*.) Repeat these steps to explore the other agency outlook definition dialog boxes. Always exit (for now) by selecting the "cancel" button; otherwise the **Order by Priority (by dragging)** dialog box is automatically invoked, which is discussed in Exercise 2h.

Exercise 2b
Experiment, similar to Exercise 2a, by selecting *Outlooks / NOAA 8-14d Outlook / Set NWS Outlook Probabilities…* or *Outlooks / NOAA 8-14d Outlook / Set Full Outlook Probabilities…*, and compare current settings for NOAA's eight-to-fourteen-day outlooks of air temperature and precipitation probabilities with (4-4) and Figure 4-6 in Croley (2000a). Experiment, similar to Exercise 2a, by selecting *Outlooks / NOAA 6-10d Outlook / Set Outlook Probabilities…*; there is no corresponding exercise in Croley (2000a) since the NOAA 6-10 day outlook of event probabilities began after that publication.

Exercise 2c
Experiment by selecting *Outlooks / old NOAA 6-10d Outlook / Set NOAA 6-10d Most-Probable Event…* to invoke the **Set NOAA 6-10d Most-Probable Event** dialog box and compare current settings already present for NOAA's six-to-ten day outlooks of most-probable air temperature and precipitation with (4-10) and Figure 4-10 in Croley (2000a). Note that this outlook of 6-10 day most-probable events is no longer made by NOAA.

Exercise 2d
Experiment by selecting *Outlooks / Environment Canada 1m Outlook / Set EC 1m Most-Probable Event…* to invoke the **Select EC 1-Month Most-Probable Event** dialog box and compare current settings for EC's one-month outlooks of most-probable air temperature with (4-12) and Figure 4-11 in Croley (2000a).

Exercise 2e
Experiment by selecting *Outlooks / Environment Canada 3m Outlook / Set EC 3m Most-Probable Event…* to invoke the **Select EC 3-Month Most-Probable Events** dialog box and compare current settings for EC's seasonal three-month outlook of most-probable air temperature and precipitation with (4-13) and Figure 4-12 in Croley (2000a).

Exercise 2f
Experiment by selecting *Outlooks / Environment Canada 3m Outlook / Set EC 3m Most-Probable Event…* to invoke the **Select EC 3-Month Most-Probable Events** dialog box and compare current settings for EC's extended seasonal three-month outlooks of most-probable air temperature and precipitation on alternate tabbed pages with Figures 4-13 and 4-14 in Croley (2000a).

Exercise 2g
Finally, select *Outlooks / Set User-Definable Probability Statement…* to invoke the **Define User Probability Statements** dialog box. Note that the equations shown there are the first five lines of (4-9) in Croley (2000a). Clear and re-check-mark the first equation to invoke the **Define User Probability Statement** dialog box (note that the latter dialog box title is singular while the former is plural). Experiment with defining various kinds of probability

statements ("Variable Type" and "Statement Type"), the definition of the reference quantiles (lower quantile probability, upper quantile probability, period of the variable, and reference period), and the statement probability. Exit by selecting the "cancel" button from both of these dialog boxes.

Exercise 2h

Starting in the **Climate Outlooks Settings Module**, double-click anywhere in the window below the "Climatic Outlooks" field. This invokes the **Order by Priority (by dragging)** dialog box. If the screen will permit it, drag the lower right corner of the dialog box to enlarge it to the point that the scroll bars disappear. Look at the alternate display by selecting the second button from the left (again, let the cursor rest on any of the buttons for a hint to appear as to its function). Experiment by selecting groups of statements in the standard *Windows* fashion (e.g., click on one, then shift-click on another to select a range; add to them with a control-click on any others). Drag to reorder and define those which are used and unused. Before exiting, select the third button from the left to reset the order to that present upon entering this dialog box, then select the first button to exit. Finally, quit the **Climate Outlooks Settings Module** without saving anything, if prompted.

Converting Old Forecast Databases

There has been a change in format, over the last few years, to two of the software-constructed databases representing user-input values taken from agency forecast probability maps. They effect files OTLKSETS.??? and OTLKEC3X.???, used respectively for certain NOAA and EC outlooks (NOAA's one and three-month climate forecasts of air temperature and precipitation event probabilities and EC's seasonal and extended three-month outlooks of most-probable air temperature and precipitation events). Should the user have these agency forecasts defined under previous versions of this software, he or she can easily convert them for use with this software. Attempting to convert OTLKSETS.??? when unnecessary will not change anything, so the user may attempt it if unsure of the earlier version. If change is necessary, the software will create a new file of the same name and rename the old to OTLKSOLD.???. Attempting to convert OTLKEC3.??? to OTLKEC3X.??? (note the change in file name) will overwrite any existing OTLKEC3X.???, so the change should be made (if necessary) before any new information is entered with this software for the EC three-month outlooks.

In the **Climate Outlooks Settings Module**, by selecting *Tools / Convert Old NOAA 1-3m Data…* the user invokes an **Instructions** dialog box explaining the conversion process for OTLKSETS.??? files. Should the user wish to proceed, click the "Yes" button; otherwise, click the "No" button. If the user proceeds and no files, OTLKSETS.???, are found, a message is given to the user and the conversion terminates. If appropriate files are found, they are converted if necessary and appropriate messages are given. By selecting *Tools / Convert Old EC 3-m Data…* the user invokes an **Instructions** dialog box explaining the conversion process for OTLKEC3.??? files. The resulting actions are similar.

Setting Allowable Agency Outlooks

Although normally never accessed by most users, there are also many reference settings available in the **Climate Outlooks Settings Module**. Figure 6 shows menus to access them. BE CAREFUL MAKING CHANGES TO THESE REFERENCE SETTINGS! DO NOT CHANGE THEM UNLESS YOU ARE SURE YOU KNOW WHAT YOU ARE DOING! The impacts of

reference setting changes can be far reaching. By selecting *File / Reference Settings / Change Agency Outlooks Used…*, the user can invoke the **Change Agency Outlooks Used** dialog box (not shown) to configure which agency outlooks are to be used henceforth. Note that the user always has access to the databases that are created for each set of agency outlooks (such as in Exercise 2), whether or not they are actually used. That is, a user can enter information for any agency outlook through the menus shown in Figure 5, even though that information may not be used subsequently (as defined in the **Change Agency Outlooks Used** dialog box). The default outlooks are all one- and 13 three-month temperature and precipitation forecasts from NOAA (56 equations), all second-week (eight-to-fourteen-day) temperature and precipitation forecasts from NOAA (4 equations), all of the old (now discontinued) six-to-ten-day temperature and precipitation most-probable event forecasts from NOAA (8 equations), all one-month temperature most-probable event forecasts from EC (3 equations), and all seasonal and extended three-month temperature and precipitation most-probable event forecasts from EC (24 equations). These total 95 equations and 100 equations are allowed. The difference is made up of user-defined statements and there are then five in the default configuration. NOTE: the default outlooks do not include the new six-to-ten day temperature and precipitation forecasts from NOAA (4 equations). To enable them, the user must invoke the **Change Agency Outlooks Used** dialog box by selecting *File / Reference Settings / Change Agency Outlooks Used…* and picking them at the expense of other outlooks. It is suggested that the old (now discontinued) six-to-ten-day temperature and precipitation most-probable event forecasts from NOAA be removed to make room for the addition. This new software will read all existing files created by the old software correctly. While the user will have little occasion to change this configuration, the flexibility allows changes in the future as new agency outlooks become available and old ones are discontinued. Sometimes, a user may wish to temporarily expand the number of user-defined statements possible by eliminating agency outlooks, and then return to the default configuration. Finally, the user may reorder the outlooks within an agency grouping. This reordering affects the default priority ordering and is usually quite unnecessary.

Defining Agency Reference Settings

The reference years and reference quantile probability definitions for each agency, as defined in Chapter 4 of Croley (2000a), are set in the default configuration of the software and may be changed as the agency changes them in the future. They are accessed through the menu shown in Figure 6. This action is similar for each agency outlook, although the quantile definitions differ from agency to agency. By selecting *File / Reference Settings / NOAA 8-14d Probability Outlooks*, *File / Reference Settings / NOAA 6-10d Probability Outlooks*, *File / Reference Settings / old NOAA 6-10d Event Outlooks*, or *File / Reference Settings / EC 1- & 3-Month Event Outlooks*, a pop-up menu appears that is similar in function to that shown in Figure 6 for *File / Reference Settings / NOAA 1- & 3-Month Probability Outlooks*. Actions for all are similar to those described here for the latter. By selecting *File / Reference Settings / NOAA 1- & 3-Month Probability Outlooks / Beginning Reference Year…*, the user invokes the **Enter Year** dialog box (not shown), where the beginning reference year can be set. The ending reference year can be set from a similar menu selection. Likewise, by selecting *File / Reference Settings / NOAA 1- & 3-Month Probability Outlooks / Lower Ref. Quant. Prob.…*, the user invokes the **Enter Probability** dialog box (not shown), where the lower reference quantile probability can be set. The upper reference quantile probability can be set from a similar menu selection.

Simulation Settings Module

The second module callable from the main window of **Derivative Outlook Weights** is the **Simulation Settings Module** and is invoked through the "Simulations" button or by selecting *Modules / Simulations*. An example display is given in Figure 7. The **Simulation Settings Module** also displays the application directory in its title. This module allows the user to set the start date for the derivative forecast (which will be generated from model simulations and meteorological forecasts) and the start date for each meteorological scenario (beginning in each year of the historical record) used in the model simulations. It also allows input of the forecast length (length of the meteorology scenarios), which scenarios to use (which years of the historical record), and the application area(s) to be used. Current values, if any, are displayed for these settings in both the **Simulation Settings Module** window (see Figure 7) and the parent **Derivative Outlook Weights** main window (see Figure 2). In both, they appear respectively in the fields: "Forecast Start Date," "Historical Start Date," "Forecast Length," "Input Time Series," and "Current Applications." These values may only be set or reset in the **Simulation Settings Module**.

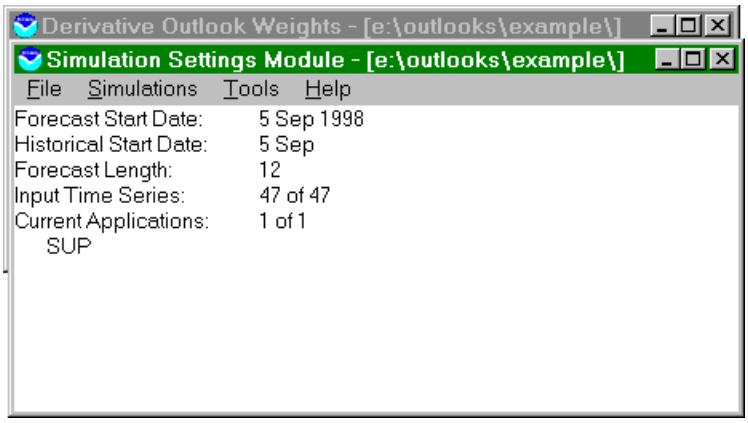

Fig. 7. "**Simulation Settings Module**" Window.

Selecting Application Areas

By selecting *Simulations / Select Areas…*, as in Figure 8, the user invokes the **Pick Applications** dialog box (not shown). From there the user can select, by check marking, one or more application areas (if respective CLIMATE.??? Files are available in the current directory) in the standard *Windows* fashion. Simply double-clicking with the mouse in or below the "Current Applications" field in the **Simulation Settings Module** window also accesses this dialog box.

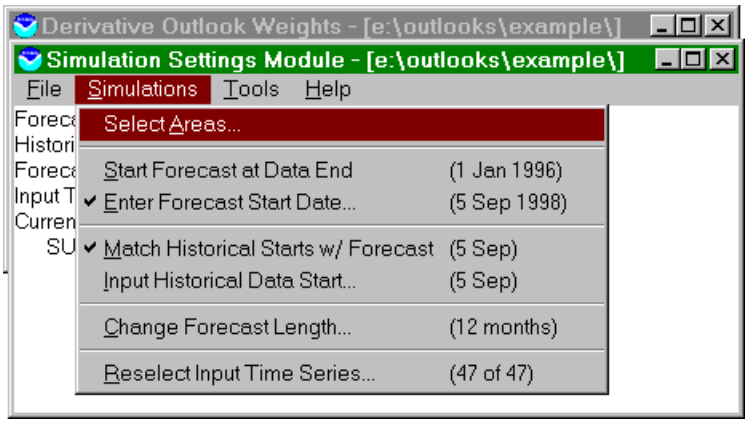

Fig. 8. "**Simulation Settings Module**" Simulations Menu.

Setting Derivative Forecast Start Date

By selecting either *Simulations / Start Forecast At Data End* or *Simulations / Enter Forecast Start Date…*, both of which are also shown in Figure 8, the user can set the derivative forecast start date. The former selection sets the start date to the day after the earliest end of the data contained in the CLIMATE.??? files corresponding to the application area(s) selected. The latter selection invokes the **Enter Date** dialog box (not shown) and allows the user to set the

start date to any day after the end of the data, but no later than the end of the year 2 years after the current date. Simply double-clicking with the mouse in the "Forecast Start Date" field in the **Simulation Settings Module** window also accesses this dialog box. [The 2 year period is changeable by selecting *File / Reference Settings / Min. Forecast Start Period…* which invokes the **Enter A Number** dialog box (not shown).]

Defining Historical Meteorology Time Series Sample

By selecting either *Simulations / Match Historical Starts w/ Forecast* or *Simulations / Input Historical Start Date…*, both of which are also shown in Figure 8, the user can set the historical start date. The former selection sets the historical start date for each meteorological scenario, beginning in each year of the historical record, to the day of the year corresponding to the selected forecast start date. The latter selection invokes the **Enter Abbreviated Date** dialog box (not shown) and allows the user to set the start date to any day of the year. Normally, this option is not used in practice. Simply double-clicking with the mouse in the "Historical Start Date" field in the **Simulation Settings Module** window also accesses this dialog box.

By selecting *Simulations / Change Forecast Length…*, which is also shown in Figure 8, the user invokes the **Enter A Number** dialog box (not shown). The user then can set forecast length to an integral value between 1 month and the number of months possible in a meteorological scenario (determined from the data period common to all of the CLIMATE.??? files, corresponding to all application areas chosen). Simply double-clicking with the mouse in the "Forecast Length" field in the **Simulation Settings Module** window also accesses this dialog box.

By selecting *Simulations / Reselect Input Time Series…*, which is also shown in Figure 8, the user invokes the **Pick Numbers** dialog box (not shown). The user then can check-mark which scenarios to use (which start years of the historical record to use). Available selections (start years) are taken from the data period common to all of the CLIMATE.??? files (only the first 150 selections are used). Simply double-clicking with the mouse in the "Input Time Series" field in the **Simulation Settings Module** window also accesses this dialog box.

Saving Simulation Settings

By selecting *File / Save Information*, when enabled, the user can save all selections made, to be used in the third module (**Mix Outlooks & Compute Weights Module**). If no selections were set or reset since the last time the **Simulation Settings Module** was used in the directory named in its title, then the *File / Save Information* menu item is disabled (grayed out). Whenever any of the fields are set or reset, the *File / Save Information* menu item is enabled.

Exercise 3

As a continuing exercise, run the *Derivative Outlook Weights* program or, if already running, exit from any module currently running, if necessary, to return to the **Derivative Outlook Weights** main window. Select *Application / Set Up Example…* to invoke the **Pick An Example** dialog box. Select "Example03", and click on the "accept selection" button on the left (let the cursor rest on any of the buttons for a hint to appear as to its function). [This action clears the EXAMPLE subdirectory, extracts files into it from the EXAMPLE03.ZIP archive (located in the EXAMPLES DATA subdirectory), and informs the user as to its successful completion]. The main window should show the EXAMPLE subdirectory appearing in the "Current Directory" field (e.g., as "e:\outlooks\example") but be otherwise empty. Then open the **Simulation Settings Module** by selecting either the "Simulations" button or *Modules / Simulations*. The

window display should be blank. Select *Simulations / Select Areas…*, to invoke the **Pick Applications** dialog box, and select the "SUP" application, which is the only one shown. Click on the "accept selection" button. The window should no longer be blank but will contain default values for all fields dependent on the contents of CLIMATE.SUP. Select *Simulations / Enter Forecast Start Date…* or double-click with the mouse on "Forecast Start Date" and enter the date 5 September 1998 and click the "OK" button. Ensure that the menu item, *Simulations / Match Historical Starts w/ Forecast*, is check-marked. Select *Simulations / Change Forecast Length…* or double-click with the mouse on "Forecast Length," enter 12 months if necessary, and click the "OK" button. Select *Simulations / Reselect Input Time Series…* or double-click with the mouse on "Input Time Series," check mark all time series if not already check-marked, and click on the "OK" button. The display should correspond to Figure 7. Select *File / Quit* or otherwise try to close the **Simulation Settings Module** window and get a message asking to quit without saving the simulate information to a file. Select the "No" button to prevent this early exit. Select *File / Save Information* and then *File / Quit*. The display should now correspond to Figure 2.

User-Supplied Historical Climate Data

The user must supply a file of historical daily air temperatures and precipitation for each application area he or she defines. The file is CLIMATE.??? (where ??? denotes the user-defined three-character mnemonic for the application area); its structure and content are defined in the **FILES** section. To facilitate the building of this file, two tools are presented in the **Simulation Settings Module**. The first tool allows the user to supply an ASCII text file of historical daily data for air temperature and precipitation and to convert it easily and quickly to the required form. By selecting *Tools / Build CLIMATE.??? File…*, the user invokes the **Pick Applications** dialog box. From there the user can select, in standard *Windows* fashion, any of the applications represented in the current directory with ASCIDATA.??? files. These files are plain ASCII text files that can be created with simple editors or re-derived from existing CLIMATE.??? files. After selection of all applications for which to build CLIMATE.??? files from ASCIDATA.??? files, the software will construct them. As an aid, the reverse operation is also provided. By selecting *Tools / Build ASCII Data File…*, the user invokes the **Pick Applications** dialog box, which is used in a similar fashion. This enables the user easily and quickly to build sample ASCIDATA.??? files, created from the example CLIMATE.??? files supplied with the software. They then can be used as a guide to format when writing the ASCIDATA.??? files for the user's own application areas.

Mix Outlooks & Compute Weights Module

The third module callable from the main window of **Derivative Outlook Weights** is the **Mix Outlooks & Compute Weights Module** and is invoked through the "Weights" button or by selecting *Modules / Weights*. An example display is given in Figure 9. The **Mix Outlooks & Compute Weights Module** also displays the application directory in its title. This module allows the user to set parameters for, and to compute, the weights to be applied to the operational hydrology sample defined with the second module (**Simulation Settings Module**), by using the meteorology outlooks defined with the first module (**Climate Outlooks Settings Module**). Therefore, this module should only be called after desired pertinent information has been set and saved in the other two modules. More specifically, this module allows the user to pick meteorology outlooks from one or more application areas and mix them into a new overall

priority ordering. It allows selection of the optimization technique and objective function to be used in searching the probability statements (representing all meteorological outlooks) for a solution. It also then allows the computation of the weights. After all settings have been defined in the **Simulation Settings Module** and the **Climate Outlooks Settings Module**, then the **Mix Outlooks & Compute Weights Module** may be invoked and run any number of times to compute alternative sets of weights as the user desires. Current values (if any) for the computation method, application area(s), and meteorological outlooks are displayed in the **Mix Outlooks & Compute Weights Module** window (see Figure 9). They appear in fields as follows. "Computation Method" displays the optimization method. If equal to "Use linear programming solution," then the simplex method solution of a set of linear equations is used with an objective function defined by the user. If equal to "Use all input time series" (as shown in Figure 9) or "Use most climatic outlooks" then either procedural algorithm 1 or 2, respectively, is used with the minimization of the sum of squared differences between the weights and unity. The three-character mnemonic for each application area appears in the main window immediately above a list of the meteorological outlooks to be used in that area. Figure 9 only shows one application area ("SUP"). The choice of computation method, selection of application area(s) for use in computing the weights, definition of objective function to be used in the optimization solution (for a linear programming solution), and the final mixing (priority ordering) of meteorology outlooks across application areas may only be set or reset in the **Mix Outlooks & Compute Weights Module**.

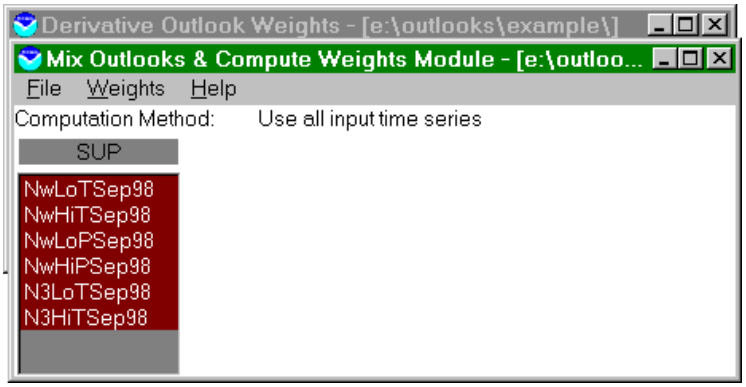

Fig. 9. "**Mix Outlooks & Compute Weights Module**" Window.

Selecting Application Areas

By selecting *Weights / Pick Outlook(s)…*, shown in Figure 10, the user invokes the **Pick Applications** dialog box (not shown). From there the user can select, by check marking, one or more (if available) application areas in the standard *Windows* fashion. The application areas listed in the dialog box consist of only those named and saved in the last invocation of **Simulation Settings Module** for which there exists a CLIMATE.??? file (??? = the application mnemonic) and for which there exists a CLIMOTLK.??? file (created and saved in the **Climate Outlooks Settings Module** for each application). For

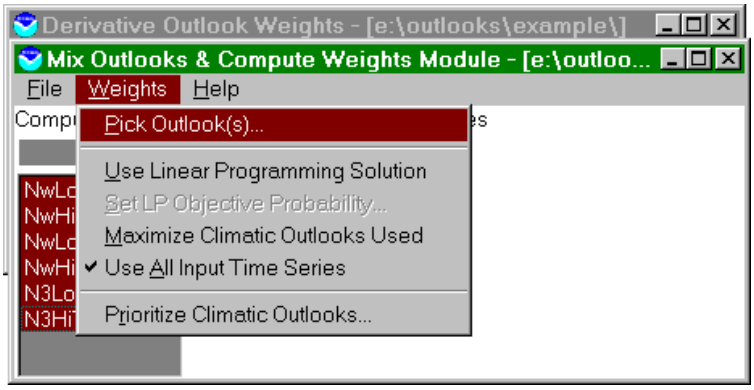

Fig. 10. "**Mix Outlooks & Compute Weights Module**" Weights Menu.

each application area selected in the **Pick Applications** dialog box, upon exit there will appear a corresponding column in the main window of the **Mix Outlooks & Compute Weights Module**.

Selecting Meteorology Outlooks

Each column in the main window of the **Mix Outlooks & Compute Weights Module** represents an application area with a list of the meteorology outlooks defined for that area (in the **Climate Outlooks Settings Module**). The user may then define which of the outlooks in the list are to be used in the computation of weights by selecting them in the standard *Windows* fashion. After doing this for all of the application areas (columns) in the main window, the user may then mix and prioritize them. Note, a total of only 100 outlooks may be selected; if more are selected at this point, the mixing and prioritizing step will not be allowed (and hence the computation of weights will not be allowed), until 100 or fewer are selected.

Mixing and Prioritizing Meteorology Outlooks

By selecting *Weights / Prioritize Climatic Outlooks…*, shown in Figure 10, the user invokes the **Order by Priority (by dragging)** dialog box (not shown) for use in arbitrarily ordering the probability statements shown therein. Then the user may simply drag the statements, displayed there, in standard *Windows* fashion to reorder and mix them. This is very similar to the action described above for the **Order by Priority (by dragging)** dialog box in the **Climate Outlooks Settings Module**. The statements listed here, however, contain identifiers as to their respective application areas.

Selecting Optimization Methodology

By check-marking *Weights / Use Linear Programming Solution*, shown in Figure 10, the user enables the use of linear programming and also enables the next menu entry, *Set LP Objective Probability…* (otherwise grayed-out). By clearing the check mark on *Weights / Use Linear Programming Solution*, the user enables minimization of the sum of squares of differences between the weights and unity and also enables menu entries for *Maximize Climatic Outlooks Used* and *Use All Input Time Series* (otherwise grayed-out). Simply clicking with the mouse in the "Computation Method" field in the **Mix Outlooks & Compute Weights Module** window also alternates between the three choices ("Use linear programming solution," "Use most climatic outlooks," and "Use all input time series").

Selecting Linear Programming Objective Function

If linear programming is to be used and the menu item for *Set LP Objective Probability…* has been enabled, then its selection will invoke the **Define LP Objective Function Events** dialog box (not shown). With this tool, the user can define any event or combination of events. Any existing user-defined events are displayed and may be added to by selecting the middle button ("define new event"). When selected, the **Define LP Objective Function Event** dialog box (not shown) is invoked to actually set the event (note the former is plural and the latter is singular). The user can then enter relevant variable type (temperature or precipitation), application area (choices are among all application areas represented in the application directory with CLIMATE.??? files), reference quantile definitions, and event dates. The beginning and ending dates may be any day from 1 January 1995 through 31 December of the year two years after the current year. [The two-year period is changeable by selecting *File / Reference Settings / User*

Event Minimum Period…, which invokes the **Enter A Number** dialog box (not shown).] The user-defined events may be further combined in the parent **Define LP Objective Function Events** dialog box by selecting one or more in the following fashion. After selecting the first event by left-clicking on it with the mouse, others may be added to it such that the result represents the intersection (AND) of all the events by shift-left-clicking on them. After selecting the first event by left-clicking on it with the mouse, others may be added to it such that the result represents the union (OR) of all the events by control-left-clicking on them. By alt-left-clicking on any single event, its complement is defined. By using these actions to define events and their intersections, unions, and complements, any complex event can be represented. By right-clicking on any of the defined events, the objective function for the optimization is defined as to maximize the probability of that event.

Once all aspects of the mixed meteorological outlooks for all application area(s) are defined, the optimization selected, and the objective function selected, the weights may be computed by selecting *File / Calculate Weights*. This action first invokes the **Order by Priority (by dragging)** dialog box (not shown), for the user to double-check his or her mixing and prioritizing of the probability statements. Then it computes the weights and places them into the file, OTLKWGTS.$$$, along with an indication of which statements were satisfied; it also places all probability statements, written in terms of their inclusion coefficients [see (6-10), (6-11), (7-5), (8-11), or (10-15) in Croley (2000a)], into the file EQUATION.$$$.

Exercise 4

As a continuing exercise, run the *Derivative Outlook Weights* program or, if already running, exit from any module currently running, if necessary, to return to the **Derivative Outlook Weights** main window. Select *Application / Set Up Example…* to invoke the **Pick An Example** dialog box. Select "Example04", and click on the "accept selection" button on the left (let the cursor rest on any of the buttons for a hint to appear as to its function). [This action clears the EXAMPLE subdirectory, extracts files into it from the EXAMPLE04.ZIP archive (located in the EXAMPLES DATA subdirectory), and informs the user as to its successful completion]. The main window should appear similar to that shown in Figure 2. Then open the **Mix Outlooks & Compute Weights Module** by selecting either the "Weights" button or *Modules / Weights*. The window display should be blank. Select *Weights / Pick Outlook(s)…*, to invoke the **Pick Applications** dialog box, and select the "SUP" application, which is the only one shown. Click the "accept selection" button (left-most button). The window should no longer be blank, but should show the continuing example as in Figure 9. Left-click with the mouse in the field "Computation Method" until it reads "Use all input time series" or (alternatively) select *Weights / Use All Input Time Series*. [If menus are used and the menu item, *Weights / Use All Input Time Series*, is grayed out, then clear the check mark on *Weights / Use Linear Programming Solution*. This will enable the desired menu item so that it then may be selected.] In the column in the main window of the **Mix Outlooks & Compute Weights Module**, entitled "SUP" (should be the only column present), select all of the meteorology outlooks listed there, if not already selected. Select *Weights / Prioritize Climatic Outlooks…* to invoke the **Order by Priority (by dragging)** dialog box. Experiment with the order but make sure to reset priorities to initial with the third button from the left before accepting the ordering. [Note that reordering is redundant in this simple example since only one application area is present (SUP) and its meteorology equations were already ordered in the **Climate Outlooks Settings Module**.] Select *File / Calculate Weights* to first invoke (automatically)

the **Order by Priority (by dragging)** dialog box (simply accept the settings this time) and then to calculate the weights. Inspect the file EQUATION.$$$ in the application directory (subdirectory EXAMPLE) and compare with (7-15) in Croley (2000a).

NOTES

- The user steps can be in almost any order after selecting an application directory. Of course, the weights computation must be the last step.
- *Help / Instructions...*, in any of the modules, gives context-sensitive suggestions depending upon the actions of the user. In the **Simulation Settings Module**, if the current directory is invalid (contains no appropriate CLIMATE.??? file) or there is a file read error on the CLIMATE.??? file, then optional instructions are available on the required format of the CLIMATE.??? file.
- Invalid responses to any query will not be accepted; each query (dialogue box) will remain until answered validly or canceled.
- Defaults for many queries (dialogue boxes) are used extensively and are determined by the last answers to the queries in a current or proceeding session.
- The user can change settings or move or resize program windows and dialogue boxes and the program saves the changes automatically. It also saves all user-entered climate outlook information automatically.
- In the **Climate Outlooks Settings Module**, the user can change display options by selecting *File / Reference Settings / Information Display* or *File / Reference Settings / Display-2* or *File / Reference Settings / Display-3*. In the **Simulation Settings Module**, the user can change display options with *File / Reference Settings / Information Display*.
- The program allows only one invocation of itself for safety's sake; if invoked while already running, the already-running instance is made the active window.

FILES

There are various files created by the program so that it may keep track of information. These files are created both in the installation directory and in the user's application area directories (e.g., subdirectory EXAMPLE). Many of these files are of no interest to the user and, furthermore, the user should not disturb them. Some files that may be of interest are detailed here in alphabetical order.

- CLIMATE.??? is a historical data file supplied by the user. It is a direct access file with two 2-byte integers per record. Record 1 is the Julian day and year of the start date of the historical data; record 2 is the Julian day and year of the end date of the historical data. The remaining records contain air temperature (first) and precipitation (second) in each record for each day of the historical period between the two dates (inclusive), listed chronologically. ANY UNITS CAN BE USED; NO MISSING DATA ARE ALLOWED. Note: the user can build this file from an ASCII data file by selecting *Tools / Build CLIMATE.??? File…* in the program's **Simulation Settings Module**; see the subsection entitled User-Supplied Historical Climate Data. The user can build an example ASCII data file from the example CLIMATE.??? files, supplied with the software, by selecting *Tools / Build ASCII Data File…* in the **Simu-**

lation Settings Module; see the subsection entitled "User-Supplied Historical Climate Data." This allows inspection of the required format to use in the ASCIDATA.??? Files.

- CLIMOTLK.??? is an output file created by the program's **Climate Outlooks Settings Module** for use in the **Mix Outlooks & Compute Weights Module**.. It contains the climate outlook information selected by the user: climatic outlook start dates, number of climatic outlook probability statements to be used, information on each climatic outlook (period, meteorological variable, and probability information), priority listing, reference period dates, and quantile periods.

- CLIMOTLK.$$$ is an output file created by the program's **Mix Outlooks & Compute Weights Module**. It contains the climate outlook information selected by the user across all of his or her application areas, for use in computing the weights. It is an optional ASCII file, enabled for output by selecting *File / Reference Settings / Output Definition Parameters (ClimOtlk.$$$)* in the **Mix Outlooks & Compute Weights Module**. Together with the files, SAMPLES.$$$ and SIMULATE.$$$, these three files completely specify all information used in the calculation of a set of weights.

- EQUATION.$$$ is an output file created by the program's **Mix Outlooks & Compute Weights Module**. It contains the equation coefficients, converted from the user's selected climate outlook information for all application areas, as in (6-11) in Croley (2000a) and the constraint equations in (7-5), the constraint equations in (8-11), or both the objective function and constraint equations in (10-15).

- OTLKN610.??? is an output file created by the program's **Climate Outlooks Settings Module**. It contains user-input values from NOAA's day 6 through day 10 (5 day) forecasts of most-probable air temperature and precipitation events in an expanding database.

- OTLKN814.??? is an output file created by the program's **Climate Outlooks Settings Module**. It contains user-input values from NOAA's day 8 through day 14 (second week) forecasts of air temperature and precipitation probabilities in an expanding database.

- OTLKEC1.??? is an output file created by the program's **Climate Outlooks Settings Module**. It contains user-input values from EC's one-month forecasts of most-probable air temperature events in an expanding database.

- OTLKEC3X.??? is an output file created by the program's **Climate Outlooks Settings Module**. It contains user-input values from EC's 4 three-month seasonal forecasts of most-probable air temperature and precipitation events in an expanding database. Earlier versions were named OTLKEC3.??? and may be converted to the present format by selecting *Tools / Convert Old EC 3-m Data…* in the **Climate Outlooks Settings Module** (see "Converting Old Forecast Databases").

- OTLKSETS.??? is an output file created by the program's **Climate Outlooks Settings Module**. It contains user-input values from NOAA's *Climate Outlook* of one-month and 13 three-month forecasts of air temperature and precipitation probabilities in an expanding database. Earlier versions of OTLKSETS.??? (188 byte line lengths) may be converted to the present format (493-byte line lengths) by selecting *Tools / Convert Old NOAA 1-3m Data…* in the **Climate Outlooks Settings Module**. Execution with a file already in the new format will not change the file (see "Converting Old Forecast Databases").

- OTLKUSER.??? is an output file created by the programs' **Climate Outlooks Settings Module**. It contains user-input values for probabilistic meteorology forecasts of the user's own definition.
- OTLKWGTS.$$$ is an output file created by the program's **Mix Outlooks & Compute Weights Module**. It contains the outlook weights corresponding to the user's settings and an indication of which meteorology probability forecast statements were used. Those marked with a "plus" (+) were satisfied and those marked with a "minus" (-) were not.
- PRIORITY.??? is an internal file created by the program. It contains user-input ordering of the climate outlooks for application area, ???, last used by the program.
- SAMPLES.$$$ is an output file created by the program's **Mix Outlooks & Compute Weights Module**. It contains all historical data assembled from CLIMATE.??? files, specified by the user, in the calculation of all quantiles and coefficients used in the construction of the equations converted from the user's selected climate outlook information for all application areas. It is an optional ASCII file, enabled for output by selecting *File / Reference Settings / Output Intermediate Data (Samples.$$$)* in the **Mix Outlooks & Compute Weights Module**. Together with the files, CLIMOTLK.$$$ and SIMULATE.$$$, these three files completely specify all information used in the calculation of a set of weights.
- SIMULATE.$$$ is an output file created by the program's **Simulation Settings Module** for use in the **Mix Outlooks & Compute Weights Module**. It contains user-selected forecast information: applications mnemonics, forecast start date, historical start date, date forecast is made, forecast length, number of time series (historical record pieces) to be used in the forecast, and start year for each piece. Together with the files, CLIMOTLK.$$$ and SAMPLES.$$$, these three files completely specify all information used in the calculation of a set of weights.

REFERENCES

Croley, T. E., II, 1996. "Using NOAA's new climate outlooks in operational hydrology." ASCE *J. Hydrol. Eng.* **1**(3):93-102.

Croley, T. E., II, 1997a. "Water resource predictions from meteorological probability forecasts." In: *Sustainability of Water Resources under Increasing Uncertainty* (Proceedings Rabat Symposium, April 1997) (ed. by D. Rosbjerg et al.), IAHS Publication No. 240, IAHS Press, Wallingford, UK, 301-310.

Croley, 1997b. "Mixing probabilistic outlooks in operational hydrology." ASCE *J. Hydrol. Eng.* **2**(4):161-168.

Croley, 2000a. *Using Meteorology Probability Forecasts in Operational Hydrology*. ASCE Press, New York, New York, 214 pp.

Croley, 2000b. "Adjusting storm frequencies for climate forecasts." Proceedings, Water Resources in Extreme Environments (ed. D. Kane), American Water Resources Association, Middleburg, Virginia, TPS-99-4, 269-274.

Croley, 2000c. "Climate-Corrected Storm-Frequency Examples." NOAA Technical Memorandum ERL GLERL-118, Great Lakes Env. Res. Lab., Ann Arbor, Michigan, 30 pp.

Croley, 2001a. "Climate-biased decisions via partial historical sampling." In: *Bridging The Gap* (Proceedings on CD, ASCE EWRI Congress, Orlando 20-24 May 2001) (eds. D. Phelps and G. Sehlke), ASCE, New York, New York, 10 pp.

Croley, 2001b. "Climate-biased storm-frequency estimation." ASCE *J. Hydrol. Eng*. **6**(4).
Croley, 2001c. "Partial-sample biased hydrologic forecasting." ASCE *J. Hydrol. Eng.* (in review).